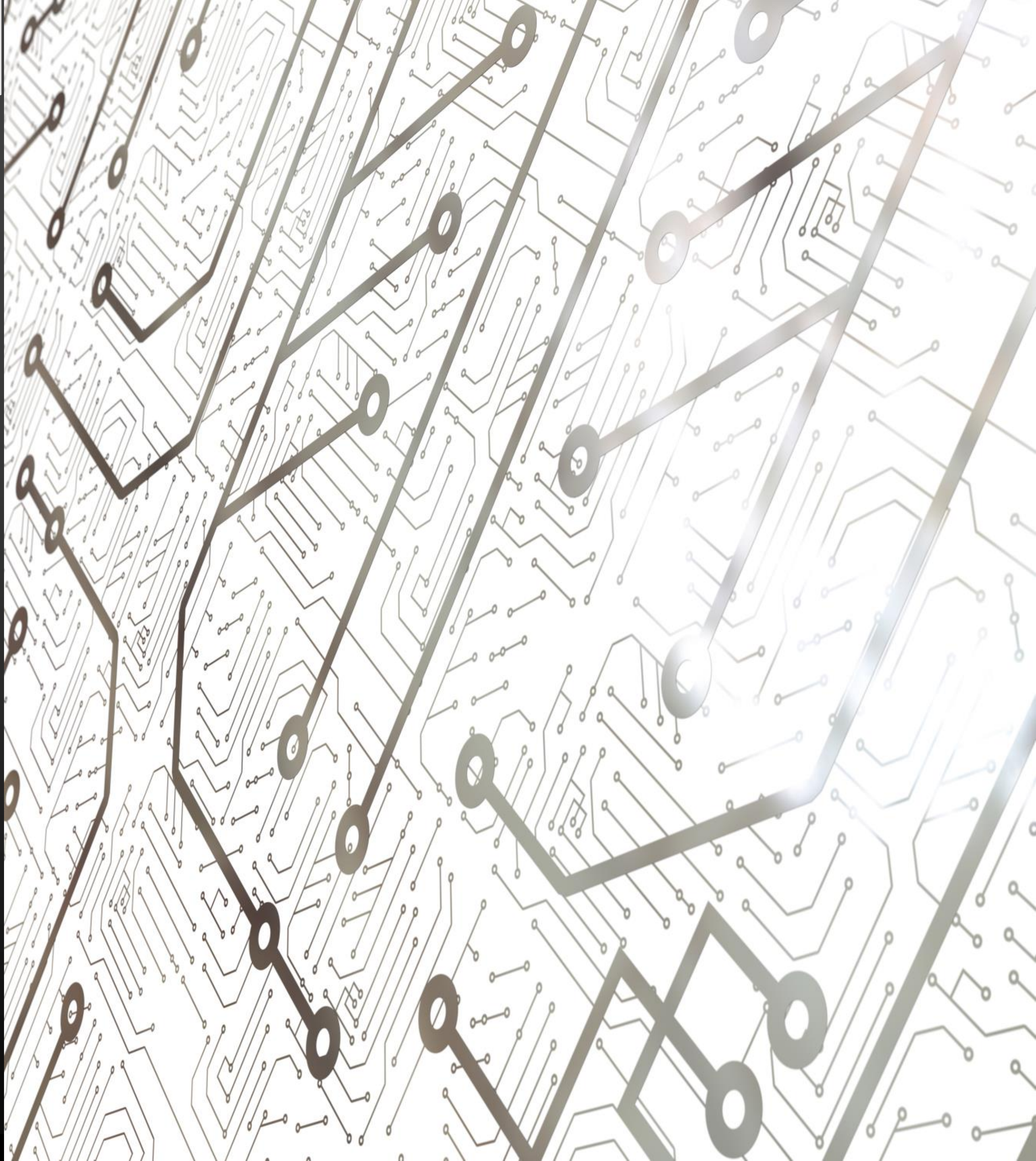
Hyogo Prefecture Himeji Nishi SHS

DR研究

an Analysis of Unpleasant sound by feature value



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1.Research Background

The bark of
rhesus macaque
feeling danger

Sound of
scratching blackboards

Unpleasant sounds

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1.Research Background

Do other animal sounds have something to do with unpleasant sounds?

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1.Research Background

Do other anim
to do wi

Researching origin of unpleasant sounds by checking their features

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2.Previous Research

Some previous research say that some unpleasant sounds have high frequencies

contradiction

Other previous studies say that some unpleasant sounds have low frequency

2.Previous Research

Some previous research say that some unpleasant sounds have high fre ies

No clear definition of it!

Other previous studies at some unpleasant sounds have low frequency

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3.Data Collection

1

- Collect 50 Life Sounds on IC recorder

2

- Conduct a questionnaire(N=58)

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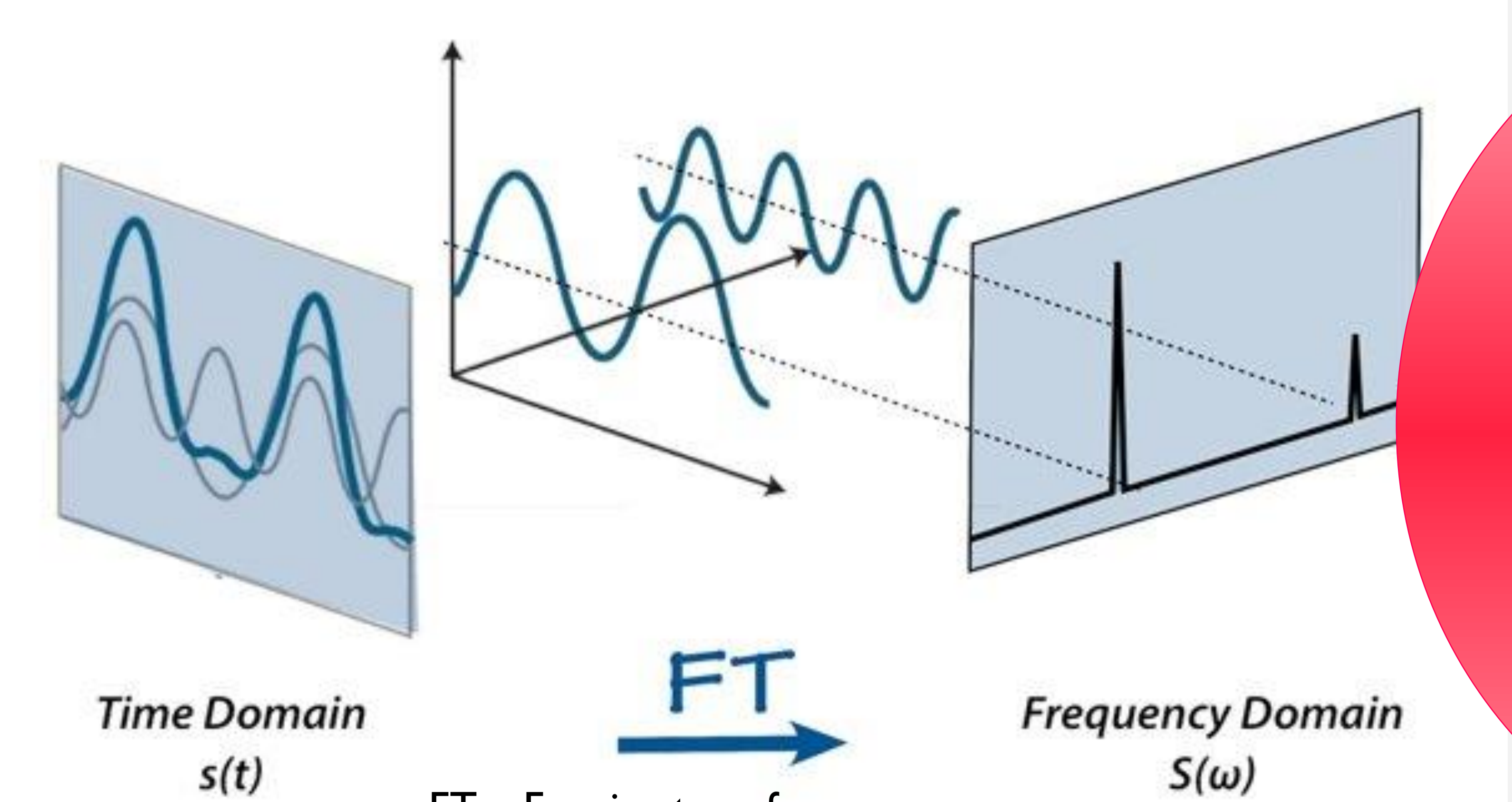
Fourier Transform



FT：Fourier transform

Convert from time domain to frequency domain

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Analysis of the data I - i　Fourie Transform

1

- Divide the sounds into two groups (Criteria : the level of unpleasantness larger than 3.5 or not)

2

- Fourie transform

3

- Comparison of graphs of large and small level of unpleasantness

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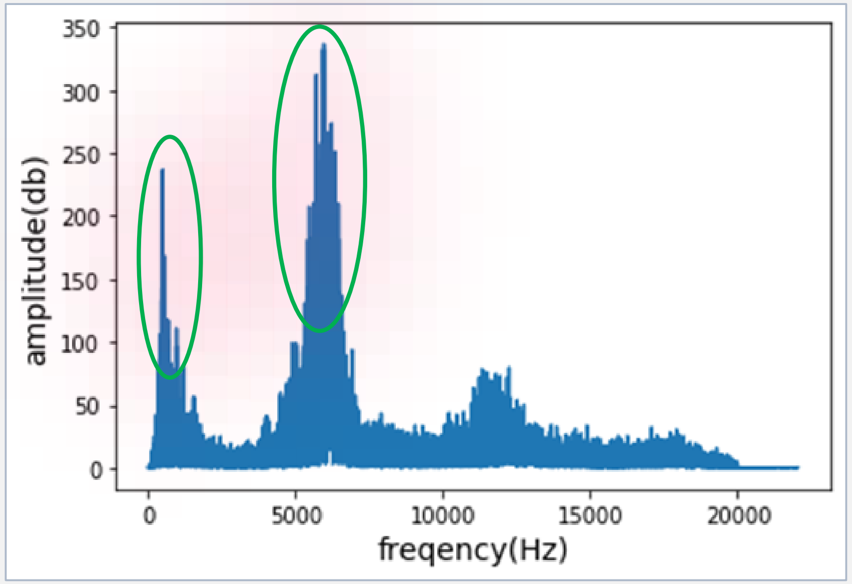
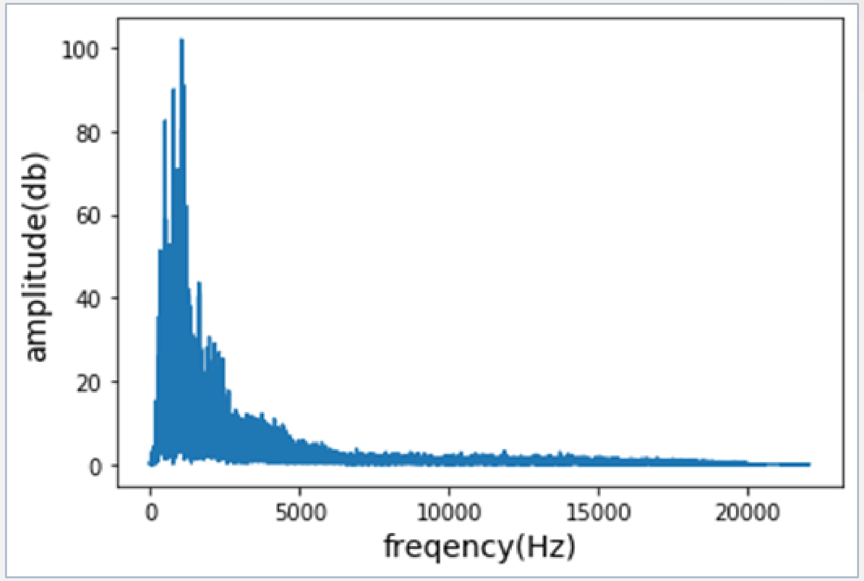
Analysis result I - i

the level of unpleasantness

Large ⟷ Small



↑ Sound of scratching blackboards



↑ Sound of woods chafing

The unpleasant sound's graph

have more than two peaks

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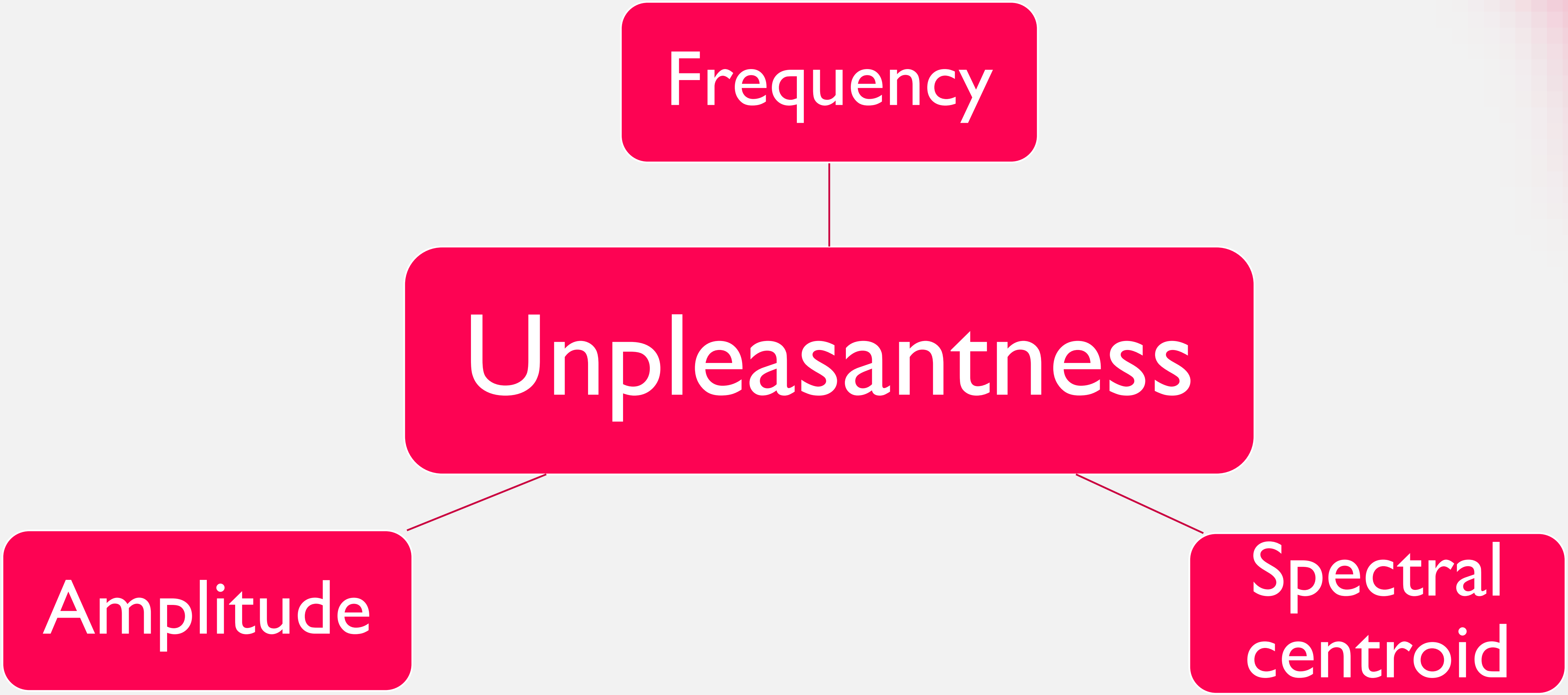
Analysis of the data I – ii Numerical Analysis

The level of unpleasantness

Average values obtained from the questionnaire

Spectral centroids

$$\text{Spectral centroids} = \frac{a_1 f_1 + a_2 f_2 + a_3 f_3 + \cdots\cdot}{a_1 + a_2 + a_3 + \cdots\cdot}$$



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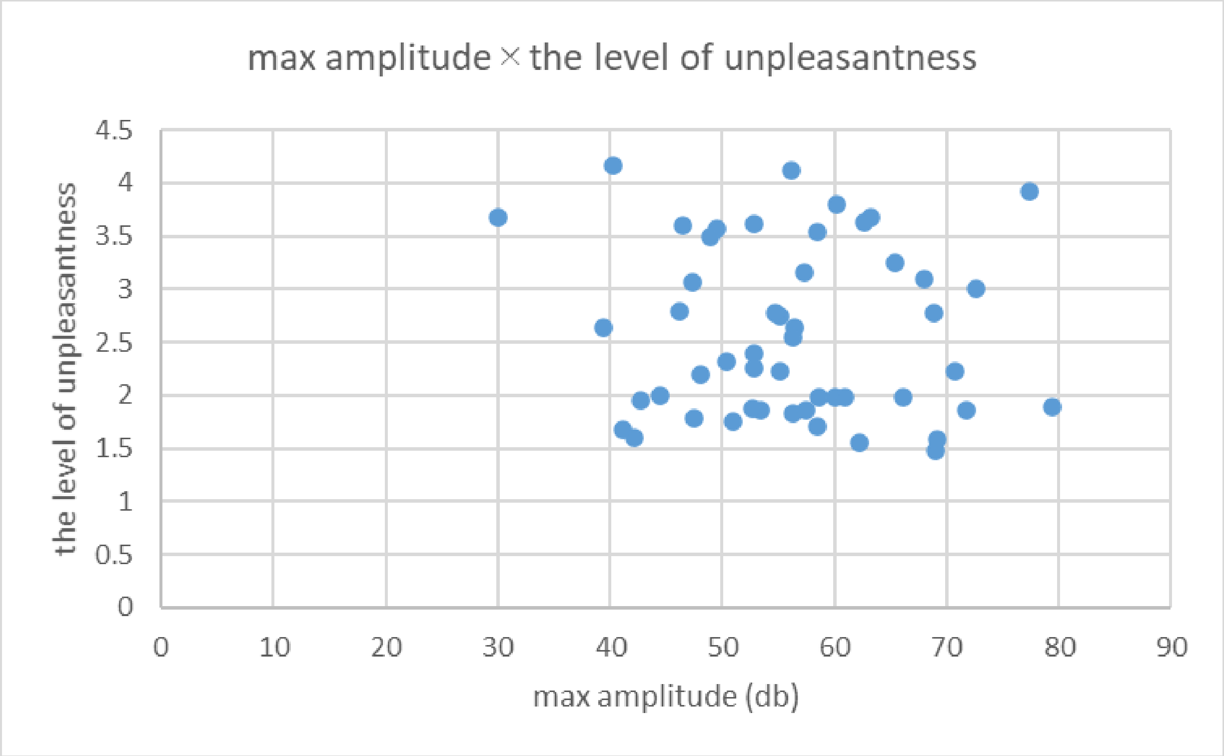
max amplitude × the level of unpleasantness



Correlation coefficient
-0.07954

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max amplitude × the level of unpleasantness

tion coefficient

-0.07954

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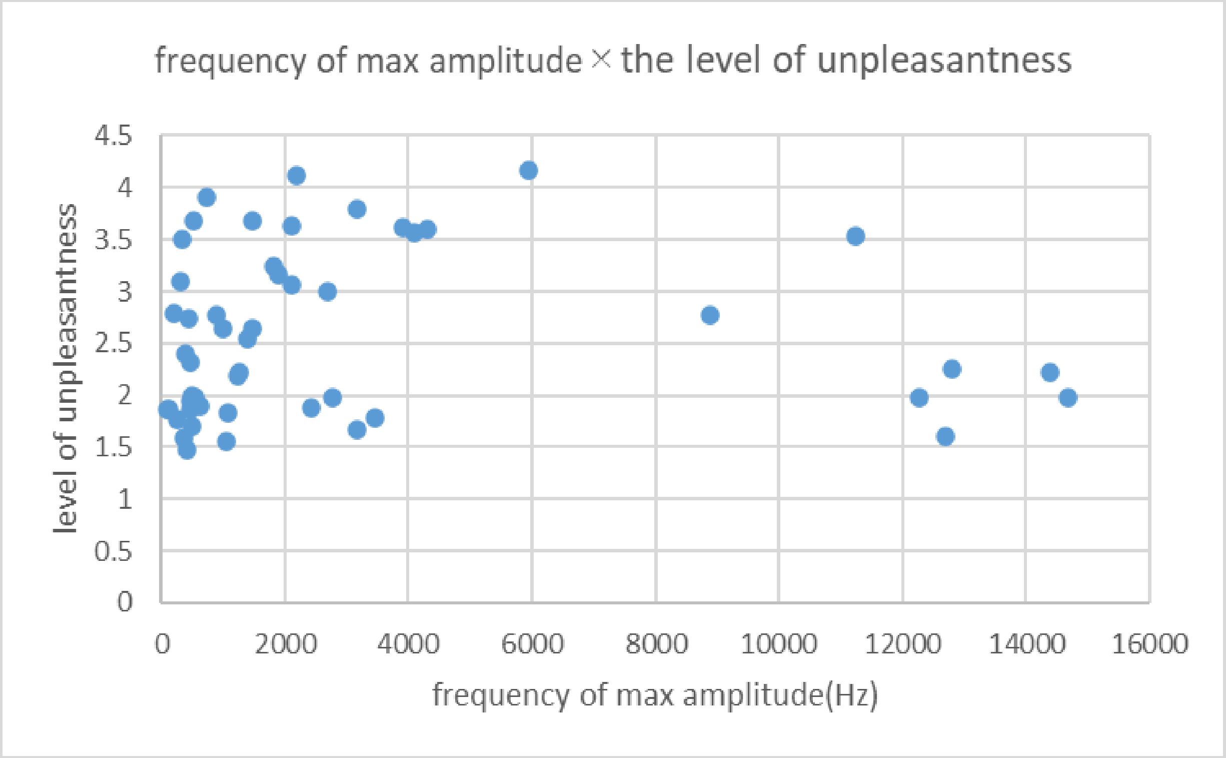
frequency of max amplitude×the level of unpleasantness



Correlation coefficient

-0.00618

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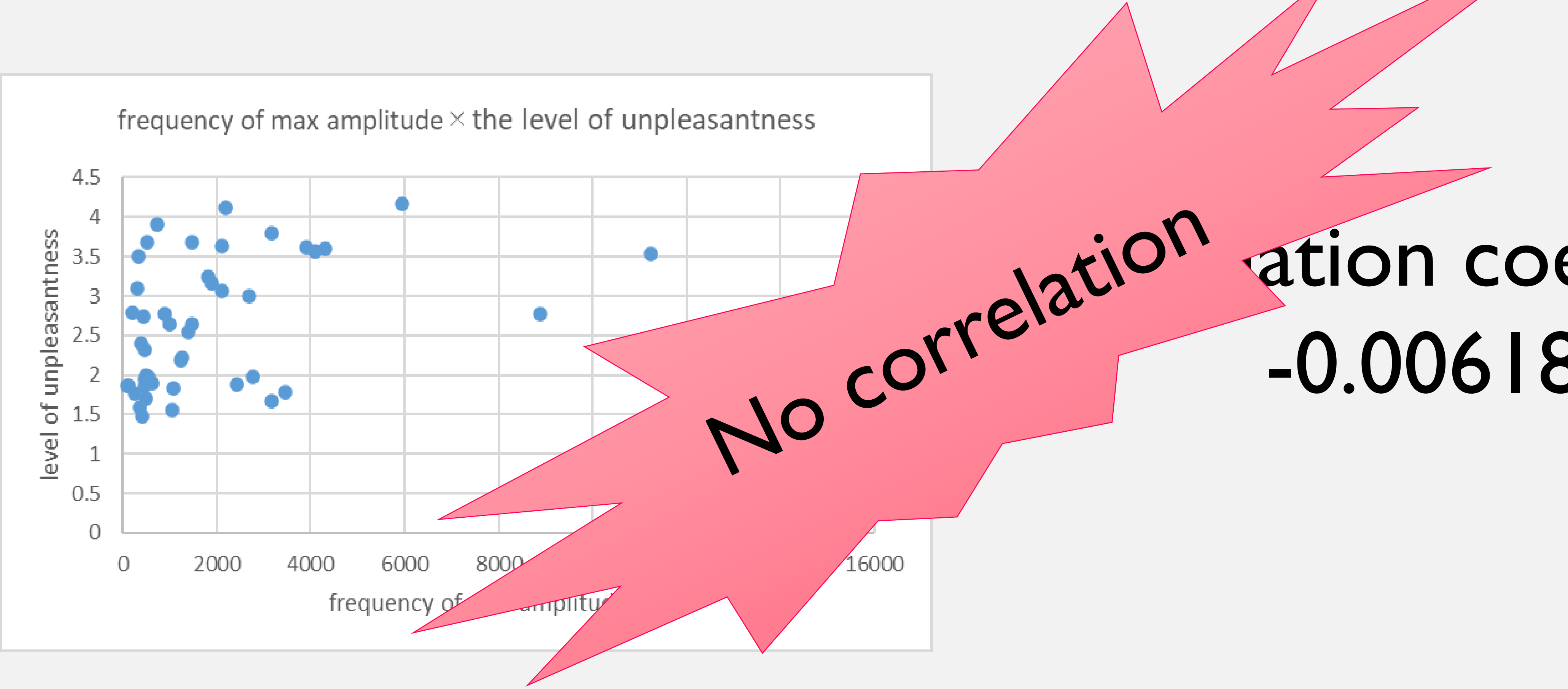
frequency of max amplitude×the level of unpleasantness



ation coefficient

-0.00618

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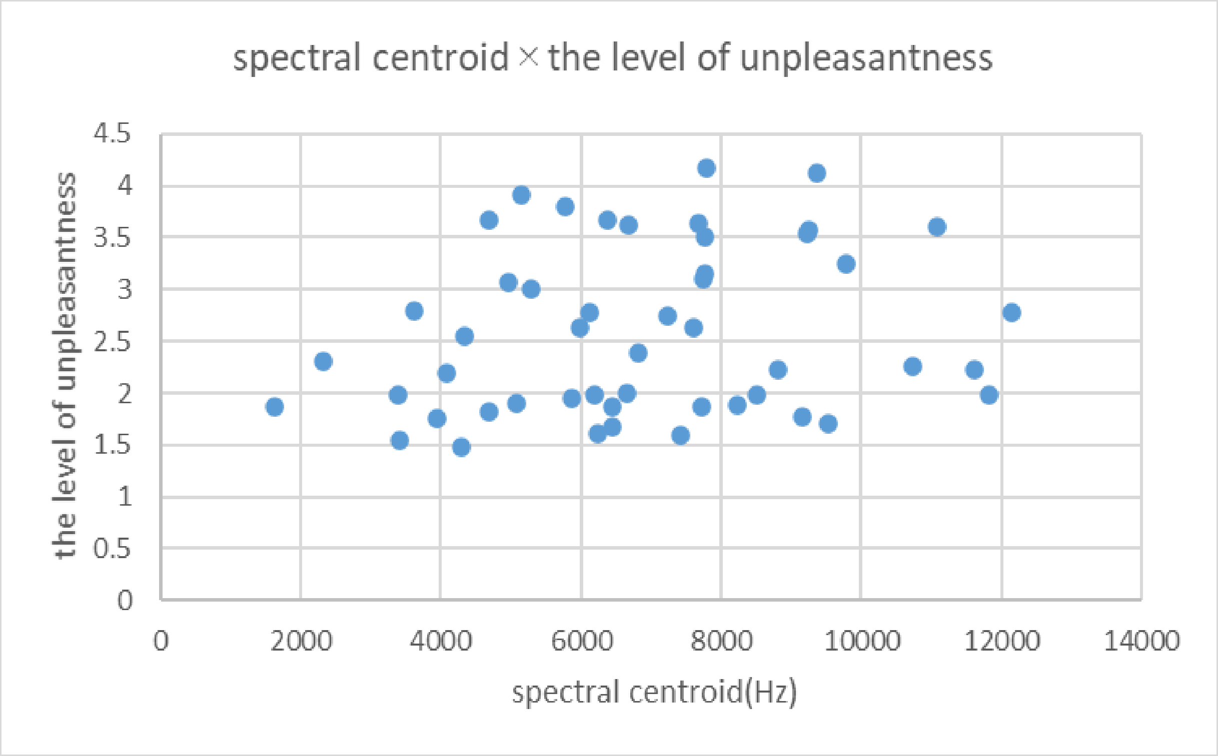
spectral centroid× the level of unpleasantness



Correlation coefficient
0.199672

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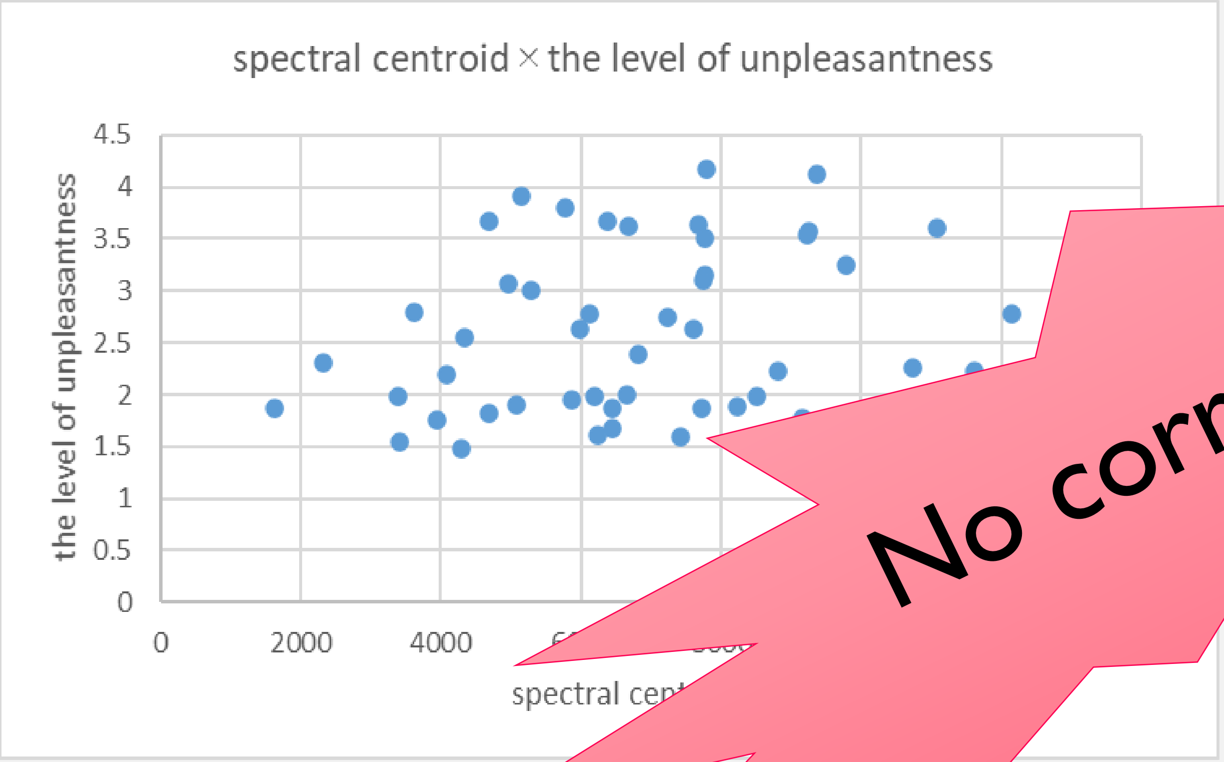
spectral centroid× the level of unpleasantness



No correlation

tion coefficient

0.199672

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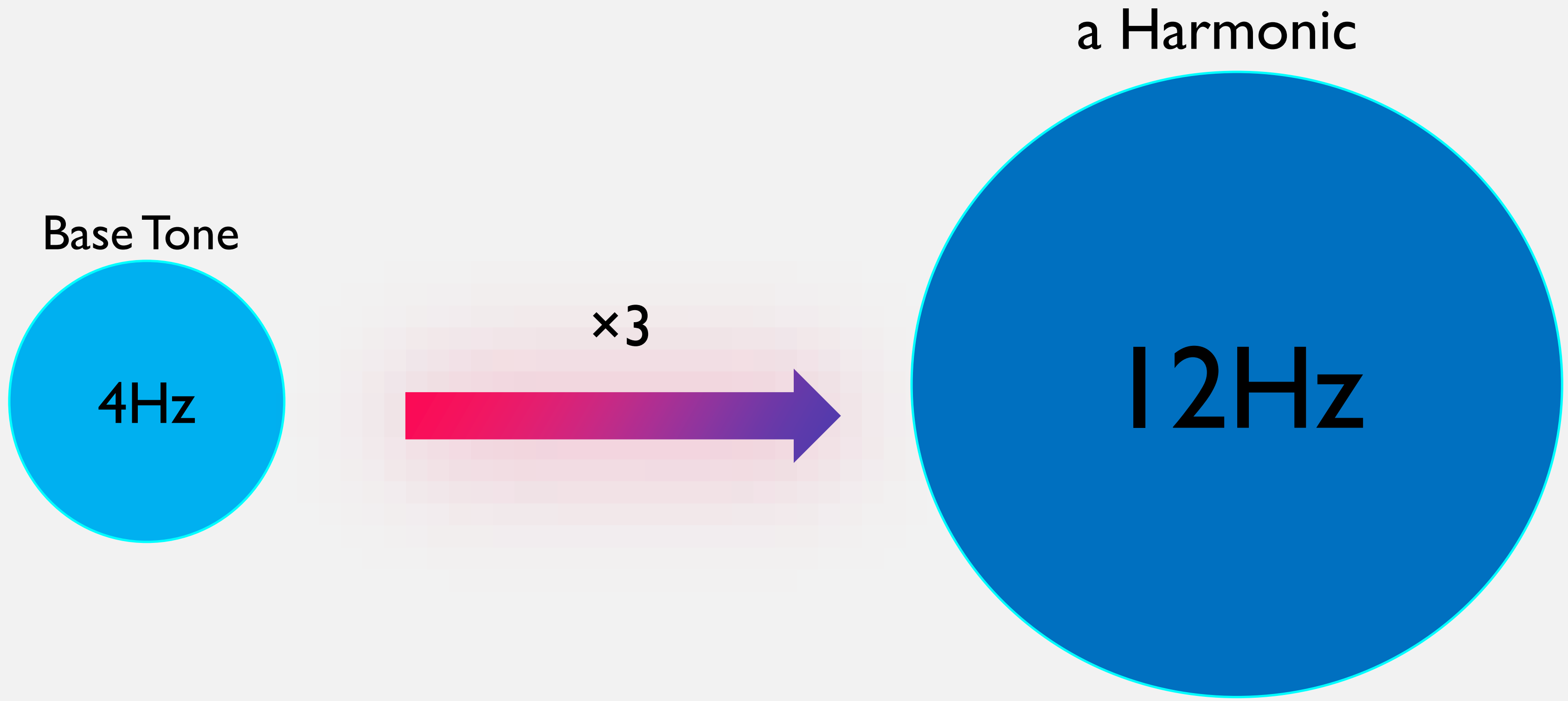
Analysis of the data Ⅰ- iii Harmonics

Exmine the relationship between harmonic of 11 unpleasant sounds and the level of unpleasantness



Analysis Result Ⅰ - iii

Sound of scratching blackboards (4.17)

Peak ratio 1:12.05466

→close to integer multiplier

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Sound of a pencil sharpener(3.91)

Peak ratio 1:1.656978

→no integer multiplier

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Sou .91)

Peak r

→p

No relationship between harmonics and the level of unpleasantness

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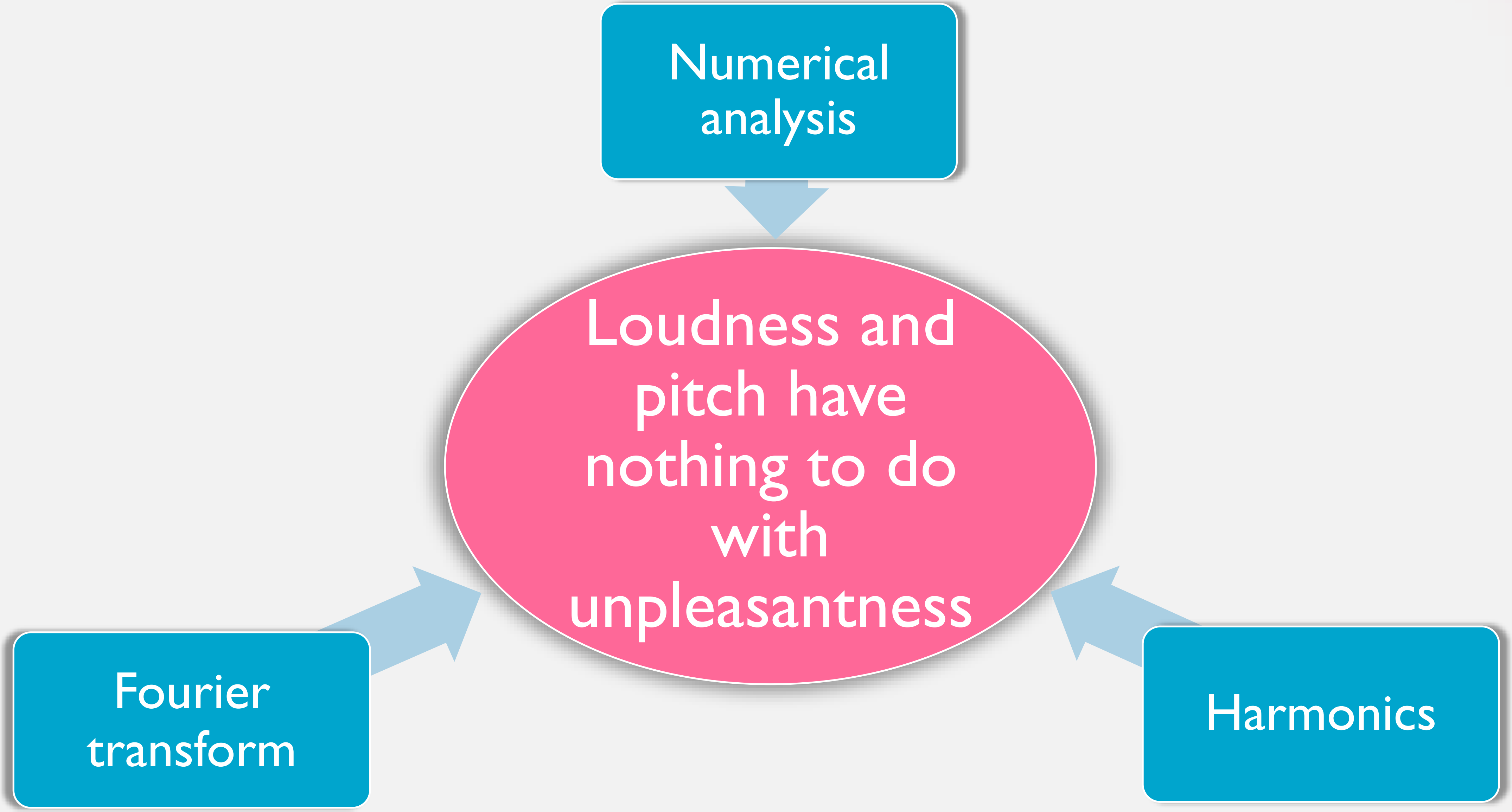
5.Discussion I



5.Discussion I

We can't define unpleasant sounds by numerical value !

tness

Fourier transform

Harmonics

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6.Analysis of the data Ⅱ

1
- It is difficult to classify sounds numerically

2
- Turn the sounds into images

3
- Divide the image into two groups by k-means method

4
- Let the machine learn about the characteristics

5
- Make the model of CNN

6
- Recognize images of sound by the model of CNN(N=51)

7
- Judge if animal sounds are unpleasant by the model of CNN

8
- Conduct a questionnaire(N=52)

9
- Comparison of the questionnaire's result and CNN model results

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7

- Judge if anim… sounds are unpleasan… model of CNN

8

- C… …=52)

9

- Compar… questionnaire's result and … model results

determine animal sounds that are unpleasant

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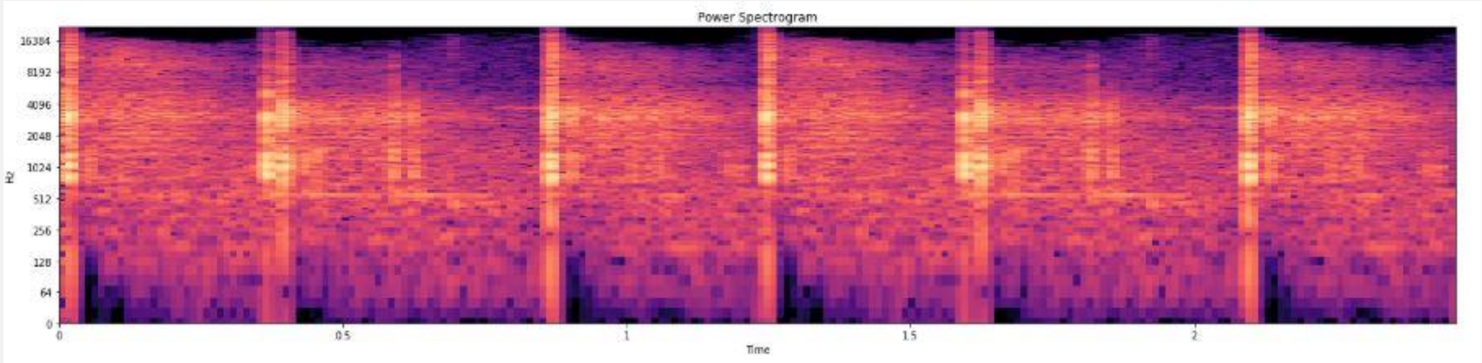
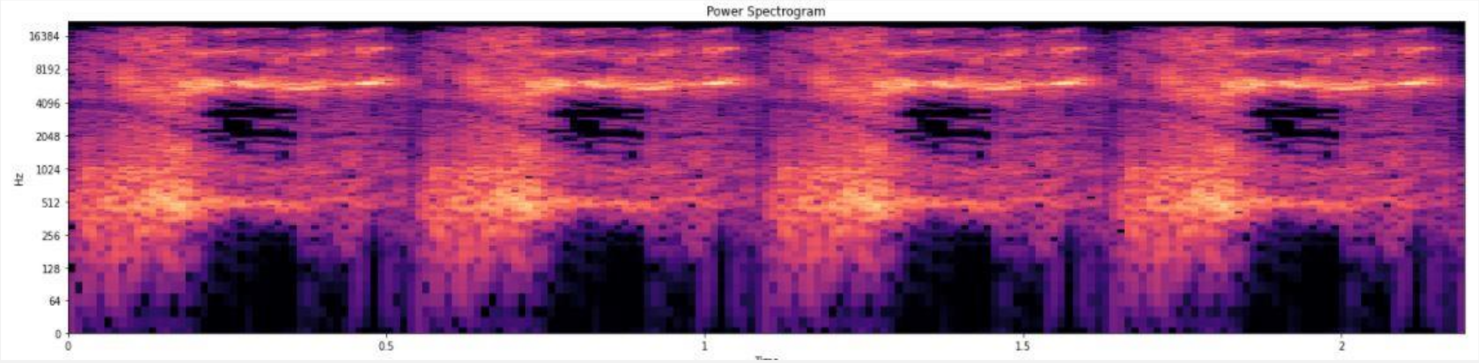
CNN(Convolutional Neural Network)

This is often used in the field of image recognition.

Example of power spectrogram



↑ sound of placing a choke



↑ sound of scratching blackboards

6 .Analysis Result Ⅱ

Unpleasant sound probability

- By the model of CNN

The level of unpleasantness

- By the questionnaire

Divide each data by k-means method

6 .Analysis Result Ⅱ

The group of high unpleasant sound probability

animals	unpleasant sound probability (%)
Black-tailed gull	93
Mecopoda nippon	92
Lion	88
Bee	88
Parrot	83
Bear	81
Cow	78
Cricket	73
Sheep	66
Coal tit	63
Dog	58

➕

The group of the large level of unpleasantness

animals	unpleasantness
Mosquito	3.288462
Deer	3.25
Black cicada	3.096154
Mecopoda nippon	3.076923
Grasshopper	2.980769
Warker's cicada	2.903846
Flies	2.692308
Parrot	2.673077
Frog	2.576923

6 .Analysis Result Ⅱ

The group of high unpleasant sound probability

animals	unpleasant sound probability (%)
Black-tailed gull	93
Mecopoda nippon	[illegible]
Lion	[illegible]
Bee	[illegible]
Parrot	[illegible]
Bear	[illegible]
Cow	[illegible]
Cricket	[illegible]
Sheep	[illegible]
Coal tit	63
Dog	58

The group of the large level of unpleasantness

[illegible]	[illegible]76923
[illegible]	2.980769
[illegible]arker's cicada	2.903846
Flies	2.692308
Parrot	2.673077
Frog	2.576923

Parrot and Mecopoda nippon has unpleasant sound

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The sound of Mecopoda nippon

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7.Discussion Ⅱ

Mecopoda nippon

Parrot

7.Discussion Ⅱ

No similarities !

Mecopoda nippon

Parrot

7.Discussion Ⅱ

Prejudice!

Mecopoda nippon

Parrot

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8 .Future Prospects

We'll analyze unpleasant sounds from the perspective of prejudice.

Find the origin of unpleasant sounds

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9.References

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- Sound Effects Gee-So-Zai　https://koukaon.g-sozai.com/
- Smartomizu https://smartomaizu.com


Thank you
for listening!